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I. Radwaste Site Selection

The Feb. 28 deadline was finally over without producing any local community that would offer voluntarily a radwaste site in its region adding more uncertainty to the future of locating suitable radwaste site in Korea.
The Korean Government publicly invited local communities in coastal regions around the South Korean peninsula in June last year to volunteer for a radwaste site which would build a radwaste storage facility with the capacity of 100,000 drums by the year 2008.
The stake is high because the on-site storage facility at each nuclear power plant site will be filled to its capacity by that time, with low and intermediate level radwastes generated by the operating plants alone. The situation will be further aggravated as 4 NPPs are under construction and 8 more units are planned by 2015.
Under the situation, it is more than an urgent task to select a suitable radwaste site within this year because the construction of necessary facilities will require at least 5 years.
There were several local communities which they said initially showed a better than average chance of winning the majority support of the community residents for the application. KEPCO and the Government then increased the incentives, in terms of financial assistance to the local communities, to $250 million from $200 million in the midst of pros and cons debate to give the pro-side a leverage. But it didn't work.
The lessons-learned in short are:

- 8 months is too short a time to get a majority support of community residents overcoming the strong and ever-growing public suspicion and opposition fueled by anti-nuclear activist groups as has been the case in many other countries.
- Korea may also need a long-term approach that calls for consistent and continuing efforts to turn-around the public opinion on this radwaste site selection matter.

Anyway the Korean Government decided to extend the application deadline for 4 more months to give some communities more time to win as they suggested.

II. Safety and Regulatory Support to the KEDO's LWR Project

The Korea Institute of Nuclear Safety (KINS) completed the training course material and text for North Korean regulatory personnel in December last year and delivered to the North in February this year. It was developed as part of a training program under the Agreement with KEDO with an aim to establish technical capability and regulatory competence for North Korean regulators at the earliest stage of the LWR Project. The Project shows some but very slow progress and currently site preparation is going on at the site and the excavation for reactor building will start pending the construction permit possibly in the later part of this year.

The training text is made of 3 basic courses, 8 specialized courses and a glossary, which are compiled into 14 volumes with a total of 7000 pages. It took KINS staff 6 months of hard work in which they put their best expertise and experience gained through the licensing and inspection of nuclear power plants in the past 20 years. KINS is planning to provide classroom training and on-the-job training pending agreement with the North Korean regulatory authority.

Currently KINS is performing safety/licensing reviews for the construction permit for the LWR Project. Major documents under review are Preliminary Safety Analysis Report (PSAR), Quality Assurance Report (QAP) for Design and Construction, and Environmental Report (ER) that were submitted to KINS in December last year.

The review is being performed in a manner fully consistent with the ROK Rules and Procedures, KINS Safety Review Guidelines and Practices, as agreed upon between KEDO and KINS. A collection of questions raised by KINS staff in the review process was sent to KEDO's LWR Project Office in February of this year for relevant resolution and clearance.

In the review, some experts from KEDO member countries are expected to join and an IAEA Design Safety Review Team is expected to visit KINS some time in June to conduct an independent safety confirmation on the LWR Project. Besides, we expect some North Korean regulatory staff will also participate in the review at KINS.

III. Sever Accident Implementation Plan

1. Background

The Korean regulatory authority has endeavored to develop a set of comprehensive and practical measures against a sever accident at nuclear power plants in Korea since 1991. In 1994, the regulatory authority issued a Nuclear

Safety Policy Statement in which it emphasized the establishment of quantitative safety goal and the introduction of probabilistic safety assessment technique for risk-informed regulation in licensing and regulation of nuclear power plant.
After a long process of consultation with experts and extensive discussion with industry representatives, the Korean Nuclear Safety Commission developed a "Severe Accident Implementation Plan" in December 1999. Then the Korea Electric Power Corp. (KEPCO) submitted its action plan to the authority, the Ministry of Science and Technology (MOST). Finally the MOST issued the "Severe Accident Implementation Plan" in December 2000.

2. Basic Direction

A. Establishment of Safety Goal

1) Quantitative Safety Goal:
   This safety goal is aimed to set a health and safety target as to protect residents living in the vicinity of a nuclear power plant. It requires that the risk of prompt fatality resulting from reactor accident should be kept below 0.1% of the total sum of prompt fatality risks associated with other accidents and it applies similarly to the case of cancer.

2) Supplementary Performance Goal:
   This goal is aimed to prevent the core damage and to mitigate the fission product releases from the containment system. It will be finalized at a time when sufficient information on domestic PSA results and related data are gained.

B. Probabilistic Safety Assessment (PSA)

1) Assessment should be performed for accident scenarios which have relatively high probabilities of core damage.
2) Assessment of available means in the NPP design and operating procedures that can improve the accident prevention and mitigation capabilities.
3) Safety improvement with due consideration of cost-benefit aspects.

C. Severe Accident Prevention and Mitigation Capability

Nuclear Power Plant should be designed and operated in such a way:

1) Capability to prevent core damage should be assured,
2) Containment should preserve its structural integrity and function as a barrier against fission product release.

D. Establishment of Implementation Plan for Severe Accident Management Program (SAMP)

1) To cut off the progression of core damage and to control the release of radioactive materials to the environment.
2) It should consist of (1) development of accident management strategies, guidelines and procedures, (2) assessment of availability of essential equipment during the accident, and (3) establishment of specific organization, training and education program.

3. Implementation Strategy

A. Operating Nuclear Power Plants

1) Individual Plant Examination (IPE) should be performed for all operating NPPs, starting with the old plants, and completed in six years' time (except those already performed level 2 PSA or IPE for internal and external events).
2) Within 2 years' time upon the completion of IPE:
    (1) Establish and implement a plan to collect and evaluate the reliability data related to safety systems and equipment;
    (2) Implement the risk reassessment program and the risk monitoring program.
3) SAMP should be established and implemented for all operating NPPs starting with the old plants and completed in six years' time (except those already established SAMP).
4) Within 1 year's time upon the completion of SAMP, submit risk reduction plan including facility improvement plan based on overall risk assessment, and its time schedule.

B. New NPPs with Current Design Base

1) Any new nuclear power plants should have, at a minimum, the capacity, in terms of functions and features to prevent and mitigate a severe accident, up to the level of Korean Standard NPP (KSNP) that is based on the design of Ulchin Units 3 & 4.
2) They should perform the level 2 PSA for internal and external events and also the low power and shutdown PSA. Develop risk reduction measures against vulnerable points identified in the final PSA.
3) Establish a plan to collect and evaluate the reliability data related to safety systems and equipment, the risk reassessment program, and the risk monitoring program. They should be implemented within 2 years' time after the commercial operation.
4) Establish SAMP before the commercial operation.

C. Advanced Power Reactors (APR 1400)

1) They should perform the level 3 PSA for internal and external events, and

also the low power and shutdown PSA so that they should meet the safety goal.
2) Adequate safety features and facilities should be equipped with based on the integral assessment, at the design stage, for severe accident prevention and mitigation.
3) The same as B.3.
4) The same as B.4.

IV. Restructuring of KEPCO and Regulatory Direction

The Korean National Assembly finally passed a bill dividing the Korea Electric Power Corporation (KEPCO) into 6 companies in December 2000. KEPCO, however, will retain its nuclear power plants and hydro-power as a state-run company. Only fossil power stations will be divided into five subsidiaries in April this year, and complete privatization will take place one year later. KEPCO will retain a 100 percent stake in the hydro and nuclear power plants, given its strategic importance to the nation.

The Korean regulatory body discussed extensively in January this year some potential challenges arising under the situation and developed its regulatory direction to assure the safety of nuclear power plant. Some of the issues of concern are:

- Reduction in investment for safety maintenance and improvement and also for long-term technology development to compete with other fossil power stations;
- Low priority on manpower development such as reduction in continued education and training for operators, engineers and technicians,
- Reduction in manpower assignment to safety and quality assurance departments;
- Pressure on regulatory body to reduce the regulatory burden;
- Pressure to reduce regulatory impact costs such as fees and research fund.

Major regulatory direction is:

- Advise and lead the industry management to place top priority on safety;
- Step up effort on safety culture such as lecture course for senior management, incentive system for excellent safety performer, etc. so that the industry may understand safety assurance is directly related to economy;
- Strengthen, in a more specific and clear manner, the qualifications for operators and key managers, the requirements for education and training, periodic inspection and maintenance, and QA system, etc.;
- On the regulatory side, improve the regulatory effectiveness through rationalization of the regulatory system.

V. Development of Risk Informed Regulations

Since 1989, the Korean regulatory authority has strongly advised the utility, KEPCO, to perform probabilistic safety assessment (PSA) for all nuclear power plants both in operation and to be built in Korea, to identify and resolve the vulnerability to severe accidents. So far, most of the nuclear power plants in operation or under construction have conducted Level 2 PSA or IPE and submitted assessment results to the regulatory authority. In 1994, the Korean regulatory authority issued the Nuclear Safety Policy Statement in which it emphasized the introduction of risk-informed regulations in licensing and regulation of all nuclear power plants. Since then, research activities have been continued to develop regulatory framework to use risk information in regulation, utilizing established PSA technique. Studies have also been going on in many regulatory areas such as RI Technical Specifications, RI IST, RI ISI, etc., in which risk information can be utilized to improve the effectiveness in regulation and also in plant operation without jeopardizing safety.

In 1999, KINS launched a program to establish relevant framework and guides for risk informed regulation to keep pace with the international trend. Currently, we are preparing a training program for KINS staff on the regulatory use of risk information.

VI. Licensing of Advanced Power Reactor (APR 1400)

The Korea Electric Power Company (KEPCO) has been developing system designs for APR 1400, which has been temporarily called Korean Next Generation Reactor (KNGR) since 1992, under the auspices of the Ministry of Commerce, Industry and Energy (MOCIE). The project has been carried out as one of the major national projects and is currently in the last stage finalizing system designs and optimizing overall systems for design certification by the end of 2002.

APR 1400 will have much improved economy and plant operational performance and also will have much enhanced safety features compared to a conventional nuclear power plant, for example, Ulchin units 3 & 4 which are the Korean Standard Nuclear Power Plant (KSNP). The first unit of APR 1400 is scheduled to start commercial operation in 2010. Major design differences between APR 1400 and KSNP are compared in Table 1.

In parallel with the development of APR 1400 system design, a set of safety requirements for the siting, design, and operation of the APR 1400 has been developed by the Korea Institutes of Nuclear Safety (KINS) since 1992. The goal of KINS in preparing these new requirements is to achieve a level of safety for APR 1400 that is enhanced relative to currently operating KSNP.

The safety requirements are given in a report entitled Safety and Regulatory Requirements and Guidance (SRRG), which consists of a set of documents that are organized into a six-level hierarchy: Safety Objectives, Safety Principles, General Safety Criteria, Specific Safety Requirements, Regulatory Guides, and Safety Review Guides.

The Atomic Energy Act was amended in December 2000, so that a standard nuclear power plant design can be certified. The design certification would be effective for 10 years from the date it is issued and would expedite significantly the licensing processes for CP and OL.

Table 1. Major Design Differences between APR1400, CE Sys80+ and KSNP

Design Features	**APR 1400**	**Sys80+**	**KSNP**
		Specifications	
1. Capacity (Mwe)	1400	1300	1000
2. Safety Goal			
- CDF(/RY)	$\leq 10^{-5}$	$\leq 10^{-5}$	10^{-4}
- Containment Failure Freq. (/RY)	$\leq 10^{-6}$	$\leq 10^{-6}$	10^{-5}
3. Design Life (yr)	60	60	40
4. Design Criteria	DBA + SA	DBA + SA	DBA
5. Containment	Cylindrical	Spherical	Cylindrical
6. ECCS			
- No. of Trains	4	4	2
- Safety Injection	DVI	Cold Leg Injection	Cold Leg Injection
- RWST location	Inside Containment	Inside Containment	Outside Containment
7. Seismic Design (g)	0.3	0.3	0.2
8. Thermal Margin (%)	10-15	15	8
9. Operator Action (min)	30	30	10
10. Radiation Source Term	Realistic	Realistic	Deterministic
11. Hot Leg Temp. (^{o}F)	615	615	621.2
12. Radiation Exposure for Workers (mSv/person/yr)	20	20	50
13. Availability (%)	90	87	87
14. Construction Period (months)	48	54	62
15. Economic Advantage over coal (%)	20	-	3